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WAR FOOD ADMINISTRATION
Food Distribution Administration

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Processed Products Standardization and Inspection Division

INSPECTORS' INSTRUCTIONS

GRADING OF CANNED PEARS

PRODUCTION

The normal production of canned pears in the United States ranges from approximately 5,000,000 to 6,000,000 cases annually, with the chief producing areas in the Pacific Northwest and in California. New York and Michigan also contribute to the pack of this commodity.

For the most part, canned pears are of the Bartlett variety. In the eastern states some Kieffer pears are packed and there is also canned a very limited quantity of D'Anjou, Bosc, and other winter varieties.

PREPARATION AND CANNING

Bartlett pears are harvested for canning just after the ripening process begins. The proper picking time is usually determined by use of a pressure testing device which records the force necessary to penetrate the flesh of the fruit. Two such devices in common use are known as the California tester and the Oregon tester. With the California tester, the pears are normally taken from the tree when they show a reading of 16 to 19 pounds. Proper picking time is indicated with the Oregon tester by readings from 25 to 28 pounds pressure.

Bartlett pears are picked into lug boxes containing from 40 to 45 pounds of the fruit and are moved from the orchards to cold storage plants.

Occasionally pears for canning are allowed to ripen at room temperature without undergoing any cold storage period. Canned pears handled in this way are known to the industry as "hot" pears.

Fruit handled "hot" is often inclined to be grainy and of poor texture as compared with cold storage pears. In addition, it is extremely difficult to ripen "hot" pears evenly with the result that often the fruit must be hand sorted, thus adding considerable cost to the packing operation.

Because of this difficulty in handling and in obtaining good quality from "hot" pears, most of the fruit used for canning is placed in cold storage for at least 7 days. Thirty to thirty-one degrees Fahrenheit is generally accepted as the ideal storage temperature for Bartlett pears. If much below this temperature, the pears will freeze, and if much above, they will break down. Temperatures from 35 to 45 degrees Fahrenheit are considered to be most dangerous, since the ripening proceeds at these temperatures but not in a normal way. The pears may assume a yellow color and yet remain hard, and the fruit may eventually "die" and never ripen properly. This condition may also be caused from lack of ventilation in storage.

Bartlett pears picked at the proper time and stored at the ideal temperature have a storage life of about 40 days. It is important that pears be placed in storage very soon after picking, since one day at orchard temperature may reduce the storage life of the fruit by as much as 10 days.

Pears are normally graded for size immediately after receipt from the orchard and while still green. The fruit is always sized according to diameter and when certain types of peeling machines are to be used, the pears are also sorted into two or three length classifications. Size grading may also be performed immediately after removal from storage, while the fruit is still hard and green. Sizing of ripe fruit is very difficult, since it usually results in serious bruising.

After grading for size, the pears are moved immediately to cold storage rooms. Here the boxes are stacked loosely to facilitate circulation and quick cooling at the center of the fruit. If the pears are not cooled quickly throughout, ripening may proceed at the core after it has been arrested at the surface of the fruit. This may result in "core breakdown" after the fruit is removed from storage for ripening.

Core breakdown is evidenced by a soft, disintegrated, over-ripe flesh adjacent to the core at a time when the outer layer of flesh next to the peel is of the proper ripeness for canning.

If the pears are stored in cold storage rooms operated in connection with the canning plant, they are removed to ripening rooms at a rate approximately equal to the daily canning capacity of the plant. Cold storage pears require from 3 to 6 days to ripen, depending upon the length of time in storage and the temperature in the ripening rooms.

By far the most common practice is to store pears in central cold storage plants in the producing areas. The fruit is held for the canner's account and is shipped to his plant at a uniform rate for canning. In some instances the canning plants are located several hundred miles from the storage plants. Pears handled in this way are generally shipped in refrigerator cars without ice and are immediately unloaded into the ripening rooms upon receipt at the canning plant.

Some packers follow a practice of simply setting the pears out of storage where they are allowed to ripen in ordinary atmospheric conditions of humidity and temperature. It is a growing practice, however, to ripen pears in specially constructed ripening rooms where the temperature and humidity are carefully controlled.

As previously mentioned, pears are withdrawn from storage for ripening at a rate equivalent to the canning capacity of the plant. Obviously, any unexpected delay in the canning operation when the plant is running to full capacity may result in loss of pears or in the packing of over-ripe fruit.

Formerly the canning of Bartlett pears was entirely a hand operation; peeling, slicing and coring being performed with special knives constructed for the purpose.

In recent years, however, the availability of satisfactory peeling and coring machines has eliminated much of the hand work. There are two types of machines in general use in the preparation of pears for canning. One of these machines involves holding the pear on a pin while knives peel the pear with a lengthwise stroke. The pear is sliced and cored in one operation by drawing the fruit across a slicing knife containing a loop knife that revolves to accomplish the coring.

The other machine operates by drawing the pear across a slicing knife and placing the two halves in pear-shaped cups. As a second operation a specially shaped knife revolves inside the cup and removes the peel with one stroke of the knife which operates in the direction of the circumference of the pear. This peeling operation tends to mold the shape of the half. The coring and stemming is accomplished in a third operation by a single knife shaped to remove calyx, seed cells, and interior stem in one stroke.

After peeling, the pears are trimmed and are usually canned from bins containing cold water with a small amount of salt added. This prevents oxidation and brown discoloration on the surface of the fruit.

Regardless of the method used for peeling and coring, the halves are conveyed to women trimmers where remaining peel, core, or stem are removed. In some instances these trimmers also sort the halves into two general grade classifications, one group consisting of the Standard, Seconds, and Water halves, and the other of Fancy and Choice halves.

After having been trimmed, the fruit is conveyed to canning bins, where packing into cans is accomplished by hand. Women doing this work sort the fruit both for grade and count and generally pack the halves with the "cups" down.

Cans of pears are often rinsed with cold water and drained prior to the addition of the packing media. This operation is for removal of particles of fruit from the canning operation or from sloughing of the halves.

Sirup or water is added to the fruit in amounts necessary to fill the container. 40 per cent sugar sirup is commonly used on Grade A or Fancy fruit; 30 per cent on Grade B or Choice; 20 per cent on Grade C or Standard; and 10 per cent on Grade D or Seconds. Some packers use dextrose or corn sugar in the preparation of sirups for canning. Normally the mixture used is about one-third dextrose and two-thirds cane sugar (sucrose). From an inspection standpoint no attempt is made to determine the presence of dextrose nor its proportion. Only in cases where a plant is under continuous factory inspection is the inspector interested in the strength and composition of the in-going sirup, and then only to the extent that requirements of Standards of Identity promulgated under the Food, Drug, and Cosmetic Act are met.

GRADING

As with other canned commodities, codes and can sizes are carefully noted on the score sheet, and net weight and vacuum readings are taken. When the can has been opened, fill one of the standard laboratory glass tubes (approximately 1-1/4" in diameter by 10" in height) for use in determining degree of sirup.

Drained weights are taken after draining exactly two minutes over an eight mesh sieve of the proper diameter. A sieve 8 inches in diameter is used for No. 2-1/2 cans and smaller, and 12 inches in diameter for No. 10 cans.

For the sake of uniformity in method between all Government bureaus, canned pears are turned cup down during the draining period. The cups that remain up after emptying the contents of the can onto the screen should be turned down in such a manner as to avoid expressing any additional liquor from the fruit. The inverting of the halves should be done during the two minute draining period and under no circumstances should the product be allowed to drain in excess of 2 minutes.

When the drained weight has been determined and recorded, carefully remove the pears to a grading tray. The halves are placed face down on the tray to facilitate the scoring for color. In removing from the draining sieve the count should be determined and recorded on the score sheet.

Brix readings are determined by use of a Brix spindle or by means of a refractometer. If the spindle is used, instructions contained in the handbook article covering the use of this instrument, Chapter V, should be followed.

In certifying the grade of canned pears, the sirup density found upon examination should be stated in connection with the grade statement, using terms as indicated in the standards.

COLOR

Color of canned Bartlett pears has not been successfully classified according to the Dictionary of Color, because two important elements enter into the scoring of this factor. These are color and translucency.

If the pears are of typical white or light, yellowish-white color and possess a uniform translucency, they may be given a credit of 18 to 20 points. To score 20 points the color must be of the character described and perfectly uniform. Any slight variation from perfection in color and translucency necessitates dropping the score to 18 or 19 points.

No "dead white" pears are permitted in the A classification. A "dead white" pear is not necessarily white in color, but this is the term applied to pears of any shade that lack translucency or have a chalky appearance. Under-ripe pears that have been processed to softness often show this condition.

If the pears show a very slight tint of brown, or if up to 10 per cent of the units are "dead white" in color, a score of 15 to 17 points may be given. Pears showing a slight lack of uniformity in color or those that are slightly less translucent than expected in Grade A pears are scored in this range.

If the pears show a slight tint of brown or a very slight pinkish color, or if they are dull or lacking translucency, a score of 12 to 14 points may be given. The pink color often noticed in pears is generally attributed to over-processing, under-cooling, or stack burn.

If this pink color is at all prominent, or if the pears show distinct brown color from oxidation or other causes, or are in any way foreign to natural pear color, they should be scored from 0 to 11 points.

Special attention is called to the fact that pears falling into the C classification with respect to color cannot be graded above U. S. Grade C or U. S. Standard, regardless of the total score for the product.

UNIFORMITY OF SIZE AND SYMMETRY

Under the factor "Uniformity of Size and Symmetry" the variation between the units as to size and symmetry is considered in addition to the count requirements. Bear in mind that either a lack of uniformity of size, as indicated by the weight variation, or a lack of symmetry between the units, or failure to meet the count requirements will reduce the score allowed for this factor.

The first step in determining the score is to establish the variation in weight between the largest and smallest half in the can. If the weight of the largest piece does not exceed the smallest by more than 20 per cent, a credit of 13 to 15 points may be given provided the units are very symmetrical. "Very symmetrical" means that all halves in any individual can are of practically equal length, width, thickness, and shape.

If some variation in symmetry is evident or if the weight of the largest half in the can exceeds the smallest by more than 20 per cent, but not by more than 40 per cent, a score in the B range, 10 to 12 points, may be given.

Where a marked lack of symmetry is noted, as, for example, the presence in the can of short-necked, thick halves together with long-necked, thin units, or when the weight of the largest half exceeds the smallest by more than 40 per cent, but not by more than twice, a credit of 7 to 9 points may be given.

If the largest half in a single can is more than twice the weight of the smallest, assign a score of 0 to 6 points.

The following table is offered as an aid in assigning a score for the factor "Uniformity of Size and Symmetry." Requirements of both columns must be met to warrant the score indicated.

Per cent by weight largest half exceeds smallest	Uniformity of Symmetry	Score
0% to 1%	Very symmetrical halves	15
1% to 10%	Very symmetrical halves	14
10% to 20%	Very symmetrical halves	13
20% to 25%	Reasonably symmetrical halves	12
25% to 30%	Reasonably symmetrical halves	11
30% to 40%	Reasonably symmetrical halves	10
40% to 60%	Only fairly symmetrical halves	9
60% to 80%	Only fairly symmetrical halves	8
80% to 100%	Only fairly symmetrical halves	7
Over 100%	Markedly unsymmetrical halves	6 or less

Do not overlook the fact that canned pears must meet three requirements to score in the various ranges for the factor "Uniformity of Size and Symmetry." In addition to the two requirements listed in the above table, the count requirements as shown in the standards for the various grades must be met. For example, although a No. 2-1/2 can of pears contains very symmetrical halves with no weight variation, but a count of 13 units, a score at the top of the B range would be necessary.

ABSENCE OF DEFECTS

The factor "Absence of Defects" is one of the most important considerations in the grading of canned pears. Since the ripening of pears for canning is in most cases a carefully controlled operation, the chief grade determining factor from the commercial standpoint is the matter of mechanical workmanship and defects.

Under the factor "Absence of Defects" there are two considerations. As used in the grades, the term "defect" or "defective unit" refers to the type of defects ordinarily considered in grading canned products, such as the presence of "corns," bruised spots, spots of discoloration, etc. In addition to these defects, certain general requirements of coring, stemming, and trimming are considered under this factor.

As used in the grades, the term "practically free" means not more than 5 per cent of defective units present, and the term "reasonably free" means not more than 10 per cent of defective units. The general requirements of coring, stemming, and trimming apply to all units in the can. For example, the grades indicate that pears scoring in the B range "may show slight evidence of double stemming." This means that all the units in the can may show this condition and still be scored in this classification; and such units are not considered in the 10 per cent of defective units allowable.

A tolerance of 10 per cent by count of the units is allowed in the A and B grade classifications for halves failing to meet the specific grade requirements as to coring, stemming, and trimming.

Halves of pears in the A grade should be cleanly cored and stemmed. In the B grade a unit possessing a very small amount of interior stem that does not affect the appearance of the product is not considered a defective unit. A half pear containing more than 1/4 of the original interior stem is considered a defective unit in the B grade. Presence of interior stem is not considered a defect in C grade since the grade specifically states that the stem may or may not be removed.

The following table outlines the requirements for the various grades of the factor "Absence of Defects." Requirements of both columns must be met for the product to score in the indicated range.

Grade	Score Range	COLUMN I Requirements as to Coring, Stemming and Trimming	COLUMN II Requirements as to Defective Units*
A	27 to 30 points	Units must be very symmetrically and cleanly cored and stemmed with no "Double stemming." Units must possess a distinct "bridge" or tie between seed cell cavity and point where calyx has been removed. Halves are smooth and untrimmed. To score in this classification, not more than 10% by count of the units may fail to meet the above requirements, but all units must meet the requirements of the B classification.	Not to exceed 5% by count, or one unit, if less than 20 units present. No peel permitted. No units crushed or broken.
B	22 to 26 points	Units must possess smooth, untrimmed backs and edges and must be reasonably cleanly and symmetrically cored and stemmed. Units may show very slight evidence of double stemming; may lack a distinct "bridge" but are not scooped out from the core cavity through the calyx end. To score in this range not more than 10% by count of the units may fail to meet the above requirements but all units must meet the requirements of the C classification.	Not to exceed 10% by count of defective units. In addition, not more than 1/4 square inch of peel present per pound of net contents, and no units are crushed or broken.
C	17 to 21 points	Units may be trimmed on back or face but not so excessively as to destroy the normal shape.** Face or half may be scooped out and interior stem may or may not be removed. To score in this range all units must meet the above requirements.	Not to exceed 20% by count of defective units. In addition, not more than 1 sq. in. of peel per pound of net contents, and not more than 10% of the units are crushed or broken.

* "Defective Units" are those halves of pears showing hail injury, scab, bruised spots, discolored areas, carpel tissue, or other abnormality covering an aggregate area equivalent to a circle 1/4 inch in diameter. Units with black or very dark spots, worm holes, or serious insect damage are considered defective units, regardless of the area of the injury.

Halves showing light colored bruises not penetrating deeply the flesh of the fruit and not exceeding an aggregate area equivalent to a circle 1/2 inch in diameter are not considered defective units in the B and C

classification. In the A range units with any interior stem remaining in the piece are considered defective units. In the B classification halves with more than 1/4 of the original interior stem remaining in the piece are considered defective.

** "Normal shape" means that the halves retain their original contour. Halves with holes through the unit or possessing deep gouges in the sides are deemed to have lost their normal shape.

Perhaps the best procedure to follow in assigning a score for the factor "Absence of Defects" is to first sort out those halves classified as defective units and determine their percentage.

Classify the remaining units as to requirements for coring, stemming, and trimming, and assign the score indicated by the lowest of these two determinations.

In other words, if a can is found to contain 18 per cent of defective units, the factor "Absence of Defects" is scored in the C range even though the remaining halves meet the requirements of the A classification as to coring, stemming, and trimming. Similarly a can containing halves showing "scooped out" faces should be scored in the C classification even though no defective units are present. If a score in the C range for "Absence of Defects" is assigned, the product cannot be graded above U. S. Grade C or U. S. Standard, regardless of the total score.

CHARACTER OF FRUIT

For the factor "Character of Fruit" canned pears are entitled to a score in the A range, 32 to 35 points, if the fruit is uniformly intact and tender, and free from noticeable graininess or toughness. Pears scoring in the top classification should be very pliable but firm enough to possess clean-cut edges and to remain intact when handled.

The color and translucency of canned pears is usually a good indication of the character of fruit and often the scoring of this factor will follow the scoring for color.

If the fruit is slightly soft, possessing very slightly frayed edges, or tends to be slightly hard or grainy, or slightly lacks uniformity of character, a score in the B range, 28 to 31 points, should be assigned.

If the fruit shows signs of immaturity, as evidenced by hardness or toughness, or possesses noticeably frayed edges, or is soft or lacking in uniformity of character, or is grainy, a credit in the C range, 24 to 27 points, is given.

Two common conditions often noticed in Bartlett pears are "hard end" and "core breakdown." Hard end pears ripen normally at the stem end but remain hard around the calyx. Varying amounts of the pear may be so

affected, and the condition is associated in the canned product with an extremely variable texture between the two ends of the half. If any noticeable hard end halves are present in the canned product, a score in the C range should be assigned. If the condition is at all prominent, the score should be dropped to the D classification.

Core breakdown has been previously mentioned and is normally occasioned by improper conditions of storage. This condition involves a soft or broken-down flesh adjacent to the core, accompanied by a normally ripened outer shell. Usually when this condition is present it is impossible to properly core the fruit, with the result that the units must be scooped out in the center. Consequently, canned pears affected with core breakdown are usually degraded with respect to "Absence of Defects." However, fruit possessing this condition to a prominent degree should also be scored in the C range with respect to character.

Very often immature pears are given a process or cook of sufficient duration to soften the halves. When this is done the halves may show no hardness, but they usually appear ragged and lacking in translucency, with some evidence of graininess. Immature pears that have been cooked soft should not be scored above the C range for character.

When canned pears are soft and mushy or are hard or prominently grainy, a credit in the D range, 0 to 23 points, is given.

As with the factors "Color" and "Absence of Defects," the factor "Character of Fruit" has a Grade C "stopper." If the product scores in the C range, 24 to 27 points, it cannot be graded above U. S. Grade C or U. S. Standard, regardless of the total score.

Attention is also called to the fact that when any one of the scoring factors falls in subdivision D, the product cannot be graded above U. S. Grade D (Seconds).

After a rating has been assigned to each factor, the total score is taken and the proper grade assigned to the product.

If canned pears fall into a grade below U. S. Grade C or U. S. Standard, the grader must determine whether the product meets the standard of quality promulgated under the Food, Drug, and Cosmetic Act. If the product fails to meet the requirements of this standard, the grade statement on the certificate should be qualified with the additional statement "Below Standard in Quality" together with the reason, such as "Blemished," "Not Well Peeled," etc.

For easy reference, the following table lists the requirements of the standard of quality under the Food, Drug, and Cosmetic Act, together with the respective statement to be used in event the product fails to comply with these requirements.

Requirements of Standard of Quality	Qualifying statement used if product fails to comply
1. All units pierced by a weight of not more than 300 grams. (Method prescribed by Food and Drug Administration.)	"Not Tender"
2. Minimum weight of halves - 3/5 oz. Minimum weight of quarters - 3/10 oz.	"Small Halves" or "Small Quarters"
3. Weight of the largest unit in container is not more than twice the weight of the smallest.	"Mixed Sizes"
4. Except in case of unpeeled pears there is present not more than 1 square inch of peel per pound of net contents.	"Not Well Peeled"
5. Not more than 20 per cent of the units in the containers are blemished.*	"Blemished"
6. Units are untrimmed or so trimmed as to preserve normal shape.	"Unevenly Trimmed"
7. Not more than 10 per cent of units (or one unit if less than 10 in container) are crushed or broken. (Units which have lost normal shape because of ripeness and show no marks of crushing are not considered to be crushed or broken.)	"Partly Crushed or Broken"

* As used in the article the term "defective unit" is synonymous with the term "blemished unit."

This article covering the grading of canned pears has made special reference to halves, which constitute by far the major portion of the pack of this commodity. The article can be used, however, in the grading of other styles, since the requirements, with certain exceptions noted in the standards, are the same.